
A New Species and Combination in Central American Solanaceae

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ABSTRACT. A new species of *Solanum* sect. *Geminata* (G. Don) Walp. (Solanaceae) from Costa Rica and Panama, *S. sotobosquense* Bohs, is described here from Limón, Costa Rica. It is morphologically most similar to *S. rovirosanum* Donn. Sm., but differs in its short, usually forked inflorescences and long fruiting pedicels. It has been named in honor of one of its collectors, D. Armando Soto, and in reference to its understory habitat. A new combination, *Cuatresia cuneata* (Standl.) Bohs, is also published here. Although based on the name *Lycianthes cuneata* Standl., this species has most commonly been considered to belong to the genus *Witheringia* L'Hér. Morphological and molecular data show that this species is a member of the genus *Cuatresia* Hunz., not *Witheringia*.

RESUMEN. Se describe aquí una especie nueva de *Solanum* sect. *Geminata* (G. Don) Walp. (Solanaceae), *S. sotobosquense* Bohs, de Limón, Costa Rica. Morfológicamente se parece a *S. rovirosanum* Donn. Sm., pero se diferencia por sus inflorescencias cortas y normalmente bifurcadas, y los pedicelos largos en fructificación. Ha sido nombrada en honor de uno de sus colectores, D. Armando Soto, y en referencia a su hábitat en el sotobosque. También se publica aquí una combinación nueva, *Cuatresia cuneata* (Standl.) Bohs. Aunque fue basado en el nombre *Lycianthes cuneata* Standl., ésta especie ha sido considerada comúnmente un miembro del género *Witheringia* L'Hér. Los datos morfológicos y moleculares muestran que ésta especie pertenece al género *Cuatresia* Hunz., no a *Witheringia*.

Key words: Costa Rica, *Cuatresia*, IUCN Red List, Panama, Solanaceae, *Solanum*, sect. *Geminata*, *Witheringia*.

A NEW SPECIES OF *SOLANUM* SECT. *GEMINATA*

Solanum L. (Solanaceae), with an estimated 1500 species, is one of the largest and most diverse genera of flowering plants (Frodin, 2004; Weese & Bohs, 2007). Within this genus, some of the most difficult species to identify are members of *Solanum* sect. *Geminata* (G. Don) Walp., which comprise over 120 taxa centered in the Neotropics. Knapp monographed

this section in 2002, but more species in this group have been discovered since the publication of her careful treatment (Knapp, 2005, 2008; Nee et al., 2006; Granados-Tochey et al., 2007). Concurrently, molecular data are helping to define the limits of the section and the phylogenetic relationships among its species. Published molecular phylogenetic studies identify a strongly supported group called the *Geminata* clade that conforms in most part to the traditional circumscription of the section (Bohs, 2005; Weese & Bohs, 2007; Knapp, 2008). Ongoing work is contributing to a detailed phylogeny of over half the species in the clade (Bohs et al., unpublished data). In addition, a large-scale project is underway to produce a species-level taxonomic treatment of the genus *Solanum* (Knapp et al., 2004; <<http://www.nhm.ac.uk/solanaceaesource>>). Together, all these activities are producing the most complete systematic picture of the genus *Solanum* ever attempted.

Work on the Solanaceae for the *Manual de Plantas de Costa Rica* (Bohs & Soto, in prep.) shows that the flora of this rather small country includes over 70 species of *Solanum*. While doing research on this flora, a new species of *Solanum* sect. *Geminata* was discovered. It is described here and compared with similar Central American species of the section.

***Solanum sotobosquense* Bohs, sp. nov.** TYPE: Costa Rica. Limón: P. N. Cordillera de Talamanca, Talamanca, sendero de Quebrada Kuisa a Río Lori, entre Ujarrás y San José de Cabécar, 09°21'00"N, 83°13'20"W, 2000 m, 16 Mar. 1993 (fl., fr.), G. Herrera 5903 (holotype, INB; isotypes, BM, CR, MO, USJ, UT). Figures 1–3.

Solano rovirosano Donn. Sm. simile, sed ab eo inflorescentiis brevibus plerumque furcatis et pedicellis fructiferis longis differt.

Shrub or small tree up to 6 m tall; stems scurfy, the surface irregularly cracking and peeling into small white or pale yellowish horizontal plates; sympodial units difoliate, geminate. Leaves simple, dimorphic, the larger blades 19–35 × 7–13 cm, ca. 2–3× as long as wide, elliptic to obovate, the smaller blades 2.5–7 × 2–4 cm, ca. 1–1.5× as long as wide, basically the same shape as the larger blades or somewhat more



Figure 1. *Solanum sotobosquense* Bohs. —A, B. Habit. —C. Inflorescence. —D. Bud (left) and opened flower (right). —E. Gynoecium. —F. Stamens. —G. Infructescence and stem cross section. A–C from *Soto et al.* 1226 (NY); D–F from *Hammel et al.* 6493 (NY); G from *Hammel* 6077 (NY).

rounded, subcoriaceous to somewhat fleshy, glabrous or very sparsely glandular-puberulent adaxially, glabrous to moderately puberulent abaxially on leaf veins and mesophyll with unbranched and often

gland-tipped hairs, the midrib scurfy; base cuneate to decurrent; margin entire; apex acute or obtuse; petioles 1–5 cm, with scurfy surface like that of the stem. Inflorescences nearly sessile or up to 1 cm, leaf-



Figure 2. Armando Soto (left) and Lynn Bohs (right) with *Solanum sotobosquense* in the Parque Nacional Tapantí, Costa Rica.

opposed, usually forked, with 15 to 30+ flowers, all flowers apparently perfect, the axes scurfy; peduncle 0.1–0.5 cm; rachis 0.1–0.7 cm; pedicels 10–18 mm in flower, 20–35 mm in fruit, erect, with corky thickenings, contiguous and overlapping, articulated at the base. Flowers with the calyx 3–4 mm, the tube 1–2 mm, the lobes often unequal, 1–3 × ca. 2 mm, deltate, obtuse to mucronate at tips, glabrous to sparsely puberulent and often scurfy; fruiting calyx somewhat accrescent, the lobes ca. 3 × 2.5–3 mm, subtending but not covering the fruit; corolla 6–9 mm, 1–2 cm diam., stellate, subcoriaceous or fleshy, white, the tube 1–1.5 mm, the lobes 5–8 × 2–3 mm, lanceolate, glabrous abaxially and adaxially; stamens equal, with filaments connate at base, the tube ca. 1 mm, the free part 0.5–1 mm; anthers 3–4 × ca. 1.5 mm, oblong, not connivent, yellow, the pores large, directed distally, opening into longitudinal slits with age; ovary densely puberulent; style 4–7 × 0.2–0.4 mm, cylindrical, straight; stigma capitate. Fruits 0.6–1 cm diam., globose, green, densely glandular- and eglandular-puberulent when young, glabrous when older, held upright; seeds ca. 2 × 2 mm, ovoid-reniform, dark brown, the surface nearly smooth.

Distribution, habitat, and phenology. The new species is an uncommon understory shrub or small tree in rainforests and cloud forests of the Cordillera de Talamanca of southern Costa Rica and adjacent parts of Chiriquí Province, Panama, at 1500–2100 m in elevation. Flowering specimens have been collected in January, March, April, June, and November; fruiting specimens have been collected in February, March, and May.

IUCN Red List category. According to the IUCN Red List criteria (IUCN, 2001), *Solanum sotobosquense* is classified as VU B1a+2a; D1 (Vulnerable; extent of occurrence less than 20,000 km² and area of occupancy less than 2000 km², populations severely fragmented and known to exist at fewer than 10 locations, and population size estimated to number fewer than 1000 individuals). Populations of this species occur in protected areas of Parque Nacional Tapantí in Costa Rica and Parque Internacional La Amistad in Costa Rica and Panama and therefore are not perceived to be under direct threat at present.

Etymology. The epithet describes the habitat of this species, in the forest understory (“sotobosque” in



Figure 3. —A. Holotype of *Solanum sotobosquense* Bohs (Herrera 5903, INB). Inset: inflorescence detail. —B. Branch of *S. sotobosquense* showing paired (geminate) unequal leaves typical of the *S. arboreum* species group of Knapp (2002).

Spanish). It also commemorates Armando Soto, a Costa Rican Solanaceae specialist who guided the author to a population of this species in Parque Nacional Tapantí, Costa Rica.

Discussion. Specimens of this new taxon have been identified as *Solanum arboreum* Dunal, *S. narcoticosmum* Bitter, *S. roblense* Bitter, and *S. vacciniiflorum* Standl. & L. O. Williams by S. Knapp (pers. comm.) and others, but these specimens do not fit with the descriptions of any of those species. *Solanum sotobosquense* is densely puberulent on the new growth with minute glandular hairs and the leaf veins and mesophyll beneath are pubescent with unbranched, often gland-tipped hairs; the new growth and leaves of *S. narcoticosmum* are glabrous. It differs from *S. arboreum* in being a shrub or small tree (vs. a rhizomatous shrub). Its minutely glandular-puberulent fruits and large flowers distinguish it from *S. roblense*. *Solanum sotobosquense* lacks the distinctive hairs with reddish cross walls found in *S. vacciniiflorum*; the smaller, bullate leaves and deflexed fruiting pedicels of the latter species also help to distinguish the two species. The very long (20–35 mm), erect fruiting pedicels of *S. sotobosquense* differ

from all the species mentioned above. *Solanum arboreum*, *S. narcoticosmum*, and *S. roblense* have erect fruiting pedicels up to about 20 mm long (to 25 mm in *S. narcoticosmum*; Knapp, 2002). The fruiting pedicels of *S. vacciniiflorum* range from 18 to 30 mm long, approaching the length of those of *S. sotobosquense*, but they are deflexed rather than erect.

Morphologically, *Solanum sotobosquense* is most similar to *S. rovirosanum* Donn. Sm. due to its large leaves, but the new species differs in its short, usually forked inflorescences (up to 1 cm long in *S. sotobosquense* vs. 1.5–8 cm long and often highly branched in *S. rovirosanum*) and long fruiting pedicels (20–35 mm long in *S. sotobosquense* vs. 8–13 mm long in *S. rovirosanum*).

Solanum sotobosquense exhibits a number of characters found in Knapp's *S. arboreum* species group, such as difoliate and geminate sympodial units with strongly dimorphic leaves, short inflorescences with overlapping pedicel scars, and erect fruiting pedicels. At least three other species of this group, *S. arboreum*, *S. ramonense* C. V. Morton & Standl., and *S. roblense*, have similar scurfy stems, major leaf veins, and inflorescence axes, where the surface cracks and

peels into small plates. Molecular data (Bohs et al., unpublished) indicate that *S. sotobosquense* may be most closely related to *S. arboreum*, *S. ramonense*, and *S. roblense* and is only distantly related to *S. rovirosanum* despite its morphological similarity to the latter species.

Paratypes. COSTA RICA. **Cartago:** ca. 15 km S of Tapantí along new rd. on E slope above Río Grande de Orosí near concrete bridge, 09°42'N, 83°47'W, 1500 m, 13 Mar. & 14 Apr. 1973 (fl.), *J. L. Gentry & W. C. Burger 2636* (MO); Parque Nac. Tapantí, Río Dos Amigos at river crossing on second concrete bridge, 1600 m, 9°41'38.9"N, 83°46'58.6"W, 11 Jan. 2006 (fl.), *D. A. Soto, L. Bohs & J. Sperry 1226* (INB, MO, NY, UT). PANAMA. **Chiriquí:** vic. of Boquete, Cerro Pate de Macho, upper NE slopes & along soggy ridge of Cont. Divide, 08°46'N, 82°25'W, 1900–2000 m, 19 June 1987 (fl.), *T. Croat 66446* (NY); region of Boquete, Cerro Horqueta, 6500 ft., 8 May 1940 (fr.), *C. & W. von Hagen 2084* (MO, NY); along trail from end of Río Palo Alto rd. to Chiriquí border with Bocas del Toro Prov. near peak of Cerro Pate Macho, 6200 ft., 20 Nov. 1978 (fl.), *B. Hammel 5820* (NY); NE of Boquete, end of rd. past Palo Alto along trail to Bocas past Cerro Pate Macho, 6200–6500 ft., 9 Feb. 1979 (fr.), *B. Hammel 6077* (NY); end of rd. past Palo Alto to Bocas, 6500 ft., 18 Mar. 1979 (fl., fr.), *B. Hammel et al. 6493* (MO, NY); trail to Cerro Pate Macho, headwaters of Río Palo Alto, above Palo Alto, 08°47'N, 82°22'W, 1700–2100 m, 15 Mar. 1982 (fl.), *S. Knapp, W. J. Kress & B. Hammel 4265* (NY); rd. to Cerro Punta Natl. Park from Alto Quiel & Boquete, 08°51'N, 82°29'W, ca. 1850 m, 16 Jan. 1986 (fl.), *G. McPherson 8040* (NY).

TRANSFER OF *WITHERINGIA CUNEATA* TO *CUATRESIA*

The tribe Physaleae Miers of the Solanaceae includes about 200 species divided into approximately 25 genera (Olmstead et al., 2008). Generic circumscriptions and phylogenetic relationships within this group have been uncertain, and taxonomic concepts have varied widely among previous workers. For instance, Hunziker (2001) placed *Cuatresia* Hunz. and *Witheringia* L'Hér. together with seven other genera in subtribe Witheringinae. However, recent molecular analyses show that *Cuatresia* and *Witheringia* are clearly distinct phylogenetically (Olmstead et al., 2008). The species commonly known as *W. cuneata* (Standl.) Hunz. was included in this study, and it emerged in a strongly supported clade with *C. exiguiflora* (D'Arcy) Hunz. and *C. riparia* (Kunth) Hunz. and not with the other four species of *Witheringia* sequenced. Furthermore, the glabrous and somewhat rubbery-textured leaves of *W. cuneata* are typical of species of *Cuatresia*, as are the dull yellow coriaceous corollas. It is thus clear that *W. cuneata* should be transferred to the genus *Cuatresia*.

Cuatresia cuneata (Standl.) Bohs, comb. nov.
Basionym: *Lycianthes cuneata* Standl., Publ. Field Columbian Mus., Bot. Ser. 4(8): 260.

1929. *Witheringia cuneata* (Standl.) Hunz., Kurtziana 5: 118. 1969. TYPE: Panama. Bocas del Toro: Research Lagoon, region of Almirante, Jan.–Mar. 1928, *G. P. Cooper 405* (holotype, F 579181; isotypes, K, NY, US).

Acknowledgments. I thank A. Soto, J. Sperry, and B. Hammel for field assistance in Costa Rica; A. Soto, B. Hammel, and J. Sperry for photos and scans; J. C. Granados-Tochoy, A. Gutiérrez, R. Levin, N. Myers, and S. Stern for laboratory assistance; R. G. Olmstead for collaboration on the *Cuatresia* molecular work; S. Knapp for expert advice about *Solanum* sect. *Geminata*; Patricia Eckel (MO) for correcting the Latin diagnosis; and Bobbi Angell for the beautiful drawing. This work was supported by the National Science Foundation Planetary Biodiversity Inventory (grant DEB-0316614 “PBI *Solanum*—A worldwide treatment”).

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